Moore’s Law

Definition

Moore’s law effectively describes the trend of computer hardware development with time, in which the number of transistors in Integrator Circuit (IC) approximately doubles every two years. One thing to be careful of is that although the name gives the sense of it being a physical law, it is rather an empirical relationship.

Limitations

1. **High temperature from high power** - higher power consumption can lead to higher overall temperature up to the point where the air cooling is not sufficient and the hardware starts to malfunction and melt.
2. **Power Increase with Transistor density** - power consumption increases with transistor density because although smaller transistor uses less power, density scaling is much faster
3. **Voltage Threshold** - Voltage scaling can reduce dynamic power consumption to the square of itself but it cannot prevent leakage power loss. Moreover, it is limited by the threshold value where it is error-prone to the noise voltage value.
4. **Quantum Mechanic Limit** - the semiconductor of the transistor requires impurities between lattice to either allow or reject electrons to go through and due to quantum effects, the size of this lattice cannot be below 2-3 atoms.
5. **Manufacturing Process** - the ICs are manufactured by exposing wafer to the electromagnetic waves but as they are becoming smaller than the wavelength of light itself, diffraction of light makes it difficult to manufacture.
6. **Quantum Tunnelling** - As the transistors get smaller, quantum tunnelling effect of the electrons becomes a problem.

References

- https://en.wikipedia.org/wiki/Moore%27s_law
- https://www.quora.com/What-are-the-physical-limits-of-Moores-Law
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